MECHANICAL PROPERTIES OF ENGELMANN SPRUCE

By

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Engelmann spruce is one of the lightest of the important commercial woods grown in the United States. The specific gravity or density of wood is a measure of the amount of wood substance per unit volume. As might be expected, therefore, the strength properties of wood are related to its density, and a lightweight wood such as Engelmann spruce is not so strong as the heavier woods. In general, this results in lightweight woods being used to the greatest extent for purposes where strength is not the main consideration and where the light color, uniform texture, and lower weight are an advantage.

The bar graphs in figure 1 show the relative weight, shrinkage, and strength of the clear wood of Engelmann spruce and a number of other commonly used species with which it is associated. The relations shown are based on average values of species and are indicative only of general trends. The properties of individual pieces or small groups of material in all species may vary considerably above or below the average. As a consequence, some overlapping between species will occur, and differences of only a few percent in property relations should not be considered too important.

The importance of strength differences depends upon the use to which a wood is put. The fact that Engelmann spruce is lighter and somewhat weaker than many of the commonly used construction woods does not mean that it cannot be utilized for purposes where strength is of some importance. In housing, for example, 2- by 4-inch studs of Engelmann spruce at the usual 16-inch spacing would be entirely satisfactory, since the size of these members is dictated more by custom than by an engineering requirement for a piece of that size. Similarly, the strength of Engelmann spruce is fully adequate to permit its use in ordinary 1-inch lumber for wall and roof sheathing, subflooring, and similar uses. For other housing members, such as floor and ceiling joists or rafters, the lower strength properties can be compensated for by using shorter spans, by increasing the size of the member to

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[1] Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

provide adequate strength for a desired span, or by the use of a better grade. These factors are taken into account in setting up maximum allowable spans. The required spans for Engelmann spruce floor joists, flat-roof joists, ceiling joists, and rafters for residential construction are listed in the Federal Housing Administration publication, "Tables of Maximum Allowable Spans," FHA Bulletin No. 2550.

For some other purposes the strength and physical characteristics of Engelmann spruce are adequate to permit its use interchangeably with comparable grades of other species having generally similar characteristics. For example, spruce (which includes Engelmann spruce) is listed among more than 20 other species that fall in group I of four groups of woods commonly used for box construction. All of the other species shown on the bar charts fall in group I also, and all woods in that group can be used interchangeably as far as the thickness of material and the size and spacing of nails are concerned. For such use, the light weight of Engelmann spruce is a distinct asset, since one of the objectives in construction of boxes and crates naturally is to reduce the weight of the shipping container to save shipping costs and facilitate handling.

Engelmann spruce, like lodgepole pine, ordinarily has smaller knots than ponderosa pine, but they are present in larger numbers. These woods are in general use for containers requiring wider and thicker slats, such as those used for shipping meat products, or for casket boxes and the like. Engelmann spruce, because of its light weight, would also be especially suitable for smaller containers in which the component parts, for the sake of convenience of manufacture, are made larger and thicker than actually required for the load to be carried.